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CI 505

# Chemistry Final Project

*Appropriate grade level:* 11-12th year high school chemistry students (Level of chemistry class depends on choice of chemicals)

*Appropriate placement within curriculum:* This project would be an application of concepts learned throughout the year and would therefore, be implemented near the end of the year when students are familiar with such concepts as-

* Nomenclature
* Complex ions
* Chemical reactions
* Solubility
* Acid/base chemistry
* Qualitative analysis

**Project Goals:**

1. Design and follow a procedure for testing unknown chemicals.
2. Conduct laboratory and informational research in order to identify unknown chemicals.
3. Use technology appropriately to conduct research throughout the project.
4. Write a report that communicates an understanding of
5. Collaborate effectively with partners and other groups to reach a consensus about the identity of the unknown chemicals.

**Scenario:**

In an effort to comply with federal regulations, the high school chemistry faculty decided to spend Spring Break updating the chemical storage room as well as their chemical records. During this arduous process, they found a number of older bottles whose labels had peeled off over time tucked in the back of a cabinet. The records they’ve kept on chemicals have become so jumbled over the years that they found it impossible to identify the contents of the bottles based solely on the records. Therefore, the chemistry faculty decided that they would enlist the help of their Chemistry classes to help identify these chemicals so they could be disposed of properly.

**Your task:**

With your lab partner:

1. Determine what information will best help you in identifying the chemicals as well as safety precautions you must take with the unknown substances and write a proposal.
2. Develop a written procedure for collecting data along with a materials list.
3. Use your procedure to test the 5 unknown chemicals in the lab. (3 days)
4. Write a report explaining the methods you used to identify the chemicals, the identity of each chemical with compelling evidence for how you reached that conclusion, and a description of safe disposal techniques for each chemical.

## Sources for research:

<https://pubchem.ncbi.nlm.nih.gov/search/search.cgi>

<http://www.msdsonline.com/msds-search/>

<http://www.chemspider.com/>

<https://www.sigmaaldrich.com/chemistry.html>

**Teacher Notes:**

Students first need to determine what information will be most helpful in identifying chemicals. They may choose to use whiteboards to brainstorm ideas as well as look back at their notes from the year. After they come up with a list of things they want to test, how these tests will be helpful, and the safety precautions they must take in dealing with these chemicals and performing these tests, students will write up a proposal. The teacher must approve the proposal before students can continue.

Next, students will write out a procedure outlining exact steps they will follow in order to carry out their proposed tests. This procedure may also include how they will be recording their data. The procedure must be approved by the teacher before students are allowed to begin work in the lab.

Once students have a plan for what they will test, how they will test it, and how they will record data, they will begin work in the lab. Students will be given 5 unknown chemicals to identify. These can be any chemicals of your choosing and you may decide to vary the number of unknowns. *Modification:* For lower level chemistry classes, metals, ionic compounds as well as nonpolar liquids may make for easier identifications. For advanced chemistry classes, try including sweet smelling aromatic compounds if organic chemistry has been covered previously in the year. Students should already be familiar with a number of available testing equipment; however there is room for creativity here and the possibility for more advanced students to test their ideas.

When students are doing the testing in lab, encourage them to collaborate with other groups to check their results if there are groups doing the same tests.

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|  | Timeline | Resources | Due Dates |
| Day 1 | Brainstorm ideas for testing  And safety precautions | Whiteboards will be used to brainstorm tests and materials |  |
| Day 2 | Develop and write proposal | Laptops for writing proposal and safety precautions | Proposal due at end of the period for teacher approval and allow teacher to gather materials needed |
| **Day 3** | Finish writing proposal |
| **Day 4** | Develop and write procedure |  | Check with teacher before going to lab stations. Finish outside of class if needed |
| Day 5 | Testing unknown samples in lab | Testing will be done at lab stations using chosen lab technology. Students may choose to use technology such as Excel for data collection as well. |  |
| Day 6 |
| Day 7 |
| Day 8 | Research | Any online resources may be used for this (I have provided a few examples). |  |
| Day 9 | Laboratory Write-up | Google Docs will be used to keep tabs on group work. | Reports will be finished outside of class and turned in for summative assessment in 3 days |

**Eight Practical Pedagogical Decisions:**

1. Highly student-centered

2. More convergent than divergent

3. Requires a year's worth of prior experiences

4. Deep knowledge required when designing laboratory procedure

5. Long duration plan, more than a week at the end of the year

6. Highly structured learning, but decisions about designing procedure are student-chosen

7, Small group- lab partners, but collaboration encouraged

8. Multiple additional resources are required

**Technology:**

* Individual whiteboards to brainstorm ideas.
* Laptops/iPads and Merck Index to research.
* Vernier LabQuests and other laboratory technologies for chemical testing.
* Google doc shared with group members so teacher can check progress and ensure that no cheating is taking place.

Example:

Bright blue powder

High boiling point/melting point

Soluble in water, insoluble in alcohol and hexane

Conducts electricity in water, but not dry

What is this unknown chemical and how should we safely dispose of it?